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PTO/SB/05 (4/98)
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No.	678-474 (P9192)
First Inventor or Application Identifier	Young-Hwan Lee
Title	Apparatus and Method for Normalizing...
Express Mail Label No.	EL393559597US

09/559691 U.S. PTO 04/27/00 jc658

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231

1. [X] * Fee Transmittal Form *(e.g., PTO/SB/17)* *(Submit an original and a duplicate for fee processing)*
2. [X] Specification [Total Pages 14] *(preferred arrangement set forth below)*
   - Descriptive title of the Invention
   - Cross References to Related Applications
   - Statement Regarding Fed sponsored R & D
   - Reference to Microfiche Appendix
   - Background of the Invention
   - Brief Summary of the Invention
   - Brief Description of the Drawings *(if filed)*
   - Detailed Description
   - Claim(s)
   - Abstract of the Disclosure
3. [X] Drawing(s) *(35 U.S.C. 113)* [Total Sheets 8]
4. Oath or Declaration [Total Pages 2]
   a. [X] Newly executed (original or copy)
   b. [ ] Copy from a prior application (37 C.F.R. § 1.63(d)) *(for continuation/divisional with Box 16 completed)*
      i. [ ] DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

NOTE FOR ITEMS 1 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).

5. [ ] Microfiche Computer Program *(Appendix)*
6. Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all necessary)*
   a. [ ] Computer Readable Copy
   b. [ ] Paper Copy (identical to computer copy)
   c. [ ] Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. [X] Assignment Papers (cover sheet & document(s))
8. [ ] 37 C.F.R.§3.73(b) Statement *(when there is an assignee)* [ ] Power of Attorney
9. [ ] English Translation Document *(if applicable)*
10. [ ] Information Disclosure Statement (IDS)/PTO-1449 [ ] Copies of IDS Citations
11. [ ] Preliminary Amendment
12. [X] Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
13. [ ] * Small Entity Statement(s) *(PTO/SB/09-12)* [ ] Statement filed in prior application, Status still proper and desired
14. [ ] Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
15. [ ] Other: .....

16. **If a CONTINUING APPLICATION,** *check appropriate box, and supply the requisite information below and in a preliminary amendment:*
[ ] Continuation [ ] Divisional [ ] Continuation-in-part (CIP) of prior application No: _____/_____
Prior application information: Examiner _____ *Group / Art Unit:* _____
For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by **reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.**

17. CORRESPONDENCE ADDRESS

[ ] *Customer Number or Bar Code Label* *(Insert Customer No. or Attach bar code label here)* or [X] *Correspondence address below*

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Name (Print/Type)	Paul J. Farrell	Registration No. (Attorney/Agent)	33,494
Signature	Paul J. Farrell	Date	4/27/00

PATENT
Atty. Docket No. 678-474 (P9192)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Assistant Commissioner
for Patents
Washington, D.C. 20231

UTILITY APPLICATION FEE TRANSMITTAL

Sir:

Transmitted herewith for filing is the patent application of

Inventor(s): Young-Hwan Lee; Min-Goo Kim; and Beong-Jo Kim

For: APPARATUS AND METHOD FOR NORMALIZING METRIC VALUES IN A COMPONENT DECODER IN A MOBILE COMMUNICATION SYSTEM

Enclosed are:

[X] 10 page(s) of specification

[X] 1 page(s) of Abstract

[X] 3 page(s) of claims

[X] 8 sheets of drawings [X] formal [] informal

[X] 2 page(s) of Declaration and Power of Attorney

[X] An Assignment of the invention to Samsung Electronics Co., Ltd.

CERTIFICATION UNDER 37 C.F.R. § 1.10

I hereby certify that this New Application Transmittal and the documents referred to as enclosed therein are being deposited with the United States Postal Service on this date April 27, 2000 in an envelope as "Express Mail Post Office to Addressee" Mail Label Number EL393559597US addressed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231.

Tidge Holmberg
(Type or print name of person mailing paper)

(Signature of person mailing paper)

[] This application claims the benefit under 35 U.S.C. §119(e) of U.S. Provisional Application(s) No(s).:

APPLICATION NO(S).:	FILING DATE
__/_____	_____
__/_____	_____

[X] Certified copy of applications

Country	Appln. No.	Filed
Korea	99-15223	April 28, 1999

from which priority under Title 35 United States Code, § 119 is claimed
[] is enclosed.

[X] will follow.

CALCULATION OF UTILITY APPLICATION FEE

For	Number Filed	Number Extra	Rate	Basic Fee $690.00
TOTAL CLAIMS	5	0	x 18 =	$0
INDEPENDENT CLAIMS	5	2	x 78 =	$156.00
[] Multiple Dep. Claim	0		260	$0
				TOTAL$846.00

[] Verified Statement of "Small Entity" Status Under 37 C.F.R. § 1.27. Reduced fees under 37 C.F.R. § 1.9(f) (50% of total) paid herewith $.

*Includes all independent and single dependent claims and all claims referred to in multiple claims. See 37 C.F.R. § 1.75(c).

[X] The amount of $40.00 for recording the attached Assignment is enclosed as a separate check.

[X] Two checks in the amount of $846.00 and $40.00 to cover the [X] recording, [X] filing fee(s) are attached.

[ ] Charge fee to Deposit Account No. 04-1121. Order No. _____
TWO (2) COPIES OF THIS SHEET ARE ENCLOSED.

[X] Please charge any deficiency as well as any other fee(s) which may become due under 37 C.F.R. § 1.16 and 1.17, at any time during the pendency of this application, or credit any overpayment of such fee(s) to Deposit Account No. 04-1121. Also, in the event any extensions of time for responding are required for the pending application(s), please treat this paper as a petition to extend the time as required and charge Deposit Account No. 04-1121 therefor. TWO (2) COPIES OF THIS SHEET ARE ENCLOSED.

Date: April 27, 2000

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APPARATUS AND METHOD FOR NORMALIZING METRIC VALUES IN A COMPONENT DECODER IN A MOBILE COMMUNICATION SYSTEM

PRIORITY

This application claims priority to an application entitled "Apparatus and Method for Normalizing Metric Value of Component Decoder in Mobile Communication System" filed in the Korean Industrial Property Office on April 28, 1999 and assigned Serial No. 99-15223, the contents of which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to an iterative decoding device and method for a mobile communication system, and in particular, to a device and method for normalizing a metric value accumulated in a component decoder of an iterative decoder in a mobile communication system.

2. Description of the Related Art

In general, iterative decoding is employed in mobile communication systems such as an IMT-2000 (or CDMA-2000) system and a UMTS system, which use a turbo code. Also, iterative decoding is employed in deep space communication systems and satellite communication systems, which use concatenated convolutional codes, concatenated block codes or product codes. The technical field of iterative decoding is

related to soft decision and optimal performance of an error correction code.

FIG. 1 shows a common iterative decoder comprising two component decoders. Referring to FIG. 1, a first component decoder 101 receives an input codeword X_k, which is systematic information, a redundancy bit Y_{1k} provided from a demultiplexer 107 (which demultiplexes input redundancy bits Y_k, which are parity information), and first extrinsic information Ext. The first component decoder 101 performs decoding on the received signals to output a primarily decoded signal relating to the decoding results. The decoded signal is comprised of codeword ingredient X_k and a second extrinsic information ingredient. An interleaver 103 interleaves the primarily decoded signal. A second component decoder 105 receives the primarily decoded signal output from the interleaver 103 and a redundancy bit Y_{2k} provided from the demultiplexer 107. The second component decoder 105 decodes the received primarily decoded signal and the redundancy bit Y_{2k} to output a secondarily decoded signal including the first extrinsic information ingredient. Further, the second component decoder 105 provides the extrinsic information Ext to the first component decoder 101 through a deinterleaver 109.

FIG. 2 shows a detailed block diagram of a component decoder. Referring to FIG. 2, the component decoder 101 includes a branch metric calculation part (BMC) 113 for performing branch metric calculation and an add & compare & selection part (ACS) 115 for performing metric calculation and comparison in each state to select a path having fewer errors.

In general, such an iterative decoder calculates a metric value M_t in accordance with Equation 1 below.

$$M_t = M_{t-1} + (u_t \times Lc \times y_{t,1}) + \left[\sum_{j-2}^{N} x_{i,j} \times L_C \times y_{i,j}\right] + (u_t \times L(u_t)) \quad \text{Eq. 1}$$

where, M_t : accumulated metric value for time t,

u_t : codeword for the systematic bit,

$x_{t,j}$: codeword for the redundancy bit,

$y_{t,j}$: received value for the channel (systematic + redundancy)

Lc : channel reliability value, and

$L(u_t)$: a-priori reliability value for time t

It is noted from Equation 1 that, with each metric calculation, the metric value M_t continuously grows due to the second, third and fourth terms. In particular, the accumulation of a high channel reliability value, i.e., the extrinsic information having the decoding result information, causes overflow. Therefore, for hardware implementation, the metric values should have a value within a specific range to avoid an overflow problem. However, the fundamental purpose of an iterative decoder is to perform iterative decoding in order to improve decoding performance (i.e., reducing BER (Bit Error Rate) or FER (Frame Error Rate)). But, after successive iterations, the metric values may increase to exceed this specific range. Thus, if a specific range for the metric values is presumed when designing the hardware of the decoder, a problem will occur when the metric value exceeds the range and creates an overflow problem.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a device and method for normalizing the accumulated metric values of each present state to prevent generation of overflow or underflow in a component decoder for a mobile communication system.

It is another object of the present invention to provide a device and method for normalizing metric values on a survival path to prevent generation of overflow in a

mobile communication system.

It is further another object of the present invention to provide a device and method for normalizing metric values on a competition path to prevent generation of underflow in a mobile communication system.

To achieve the above and other objects, there is provided a method for normalizing metric values in a decoder which uses a plurality of metric values of a next state in a state transition period having a present state and the next state, each metric value having a survival path metric value having a value equal to or higher than a competition path metric value. The method comprises detecting the survival path metric values out of the metric values; detecting a minimum survival path metric value out of the detected survival path metric values; determining whether the detected minimum survival path metric value exceeds a threshold value; and subtracting, when the minimum survival path metric value exceeds the threshold value, a given normalization value from the metric values, to output normalized metric values.

There is also provided a method for normalizing metric values in a decoder which uses a plurality of metric values of a next state in a state transition period having a present state and the next state, each metric value having a survival path metric value having a value equal to or higher than a competition path metric value. The method comprises detecting the competition path metric values out of the metric values; detecting a minimum competition path metric value out of the detected competition path metric values; determining whether the detected minimum competition path metric value is greater than a threshold value; and subtracting, when the minimum competition path metric value is greater than the threshold value, a given normalization value to output normalized metric values.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

FIG. 1 is a block diagram illustrating a general iterative decoder including two component decoders;

FIG. 2 is a detailed block diagram illustrating the component decoders of FIG. 1;

FIG. 3 is a schematic diagram illustrating a metric value normalization device in the ACS of the component decoder according to a first embodiment of the present invention;

FIGS. 4A and 4B show a method for normalizing metric values according to the first embodiment of the present invention;

FIG. 5 is a flow chart illustrating a metric value normalization procedure according to the first embodiment of the present invention;

FIG. 6 is a schematic diagram illustrating a metric value normalization device in the ACS of the component decoder according to a second embodiment of the present invention;

FIGS. 7A and 7B show a method for normalizing metric values according to the second embodiment of the present invention; and

FIG. 8 is a flow chart illustrating a metric value normalization procedure according to the second embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention will be described herein below

with reference to the accompanying drawings. In the following description, well-known functions or constructions are not described in detail since they would obscure the invention in unnecessary detail.

A component decoder according to the present invention includes a branch metric calculation part 113 and a normalization part 115. The branch metric calculation part 113 performs branch metric calculation on the received extrinsic information, codeword and redundancy bits, and provides its outputs to the normalization part 115. The normalization part 115 receives metric values from the branch metric calculation part 113 and performs addition, comparison and selection (ACS) on survival path metric values and competition path metric values. Further, when state values of the survival path metric values or the competition path metric values exceed a threshold value, the normalization part 115 normalizes the metric values by subtracting a specific value therefrom.

There are two methods for normalizing the accumulated metric values according to the present invention. A first method uses the accumulated survival path metric values, and a second method uses the accumulated competition path metric values.

A. First Embodiment

First, with reference to FIGS. 3 and 4, the first normalization method will be described. FIG. 3 shows, for a constraint length K=3, how the normalization part 115 transitions to the next state according to a first embodiment of the present invention. FIG. 4 shows values of the states shown in FIG. 3. The metric value normalization device according to the first embodiment of the present invention will be described with reference to FIGS. 3 and 4. Herein, the "metric values" refer to a plurality of metric

values each including a pair of the survival path metric values and the competition path metric values.

For K=3, the number of memories is 2 and the number of possible states is 4. Each state includes the survival path metric value "Sur" and the competition path metric value "Cpt". The survival path metric values and the competition path metric values of the next state are determined by adding their branch metrics to the survival path metric and the competition path metric when transitioning to the next state. The branch metric value-added metric values are compared to select the higher value so as to determine a metric value of the next state. Here, a surviving metric is the survival path metric. Although the competition path metric is never selected, it continuously transitions along with the survival path metric. Although FIG. 3 shows a transition between the states having the same state index, the next state index can be varied according to the properties of the component decoder. The metric values of the present states are applied to associated adders 301. A comparator 117 detects the survival path metric values Sur out of the metric values of the present states. After detecting the survival path metric values Sur, the comparator 117 selects the minimum Sur value Sur_{MIN} from the detected Sur values and provides the selected Sur_{MIN} value to be subtracted in the adders 301 (as indicated by the negative sign in FIG. 3). Here, subtraction can be performed only when the Sur_{MIN} value exceeds a threshold value. This is to avoid performing subtraction when the Sur values are already small. The adders 301 subtract the Sur_{MIN} value from the corresponding Sur values to output normalized Sur metric values. In FIG. 4A, the Sur value of the state S1 is the minimum Sur value. As shown in FIG. 4B, the Sur values of the respective states S0-S3 are reduced by subtracting the Sur_{MIN} value therefrom.

FIG. 5 shows a method for normalizing accumulated metric values according to the first embodiment of the present invention.

Referring to FIG. 5, the comparator 117 detects metric values Sur for the four present states in step 401. After detecting the metric values Sur, the comparator 117 detects the minimum Sur value Sur_{MIN} out of the metric values Sur in step 403. After detecting the Sur values and the Sur_{MIN} value in steps 401 and 403, the comparator 117 transfers the Sur_{MIN} value to be subtracted from the respective Sur values to normalize the Sur values in step 405, and the normal addition, comparison and selection operation is performed in step 407.

B. Second Embodiment

With reference to FIGS. 6 to 8, the second normalization method will be described. FIG. 6 shows a structure of the normalization part 115 according to the second embodiment of the present invention.

The second normalization method shown in FIG. 6 is a method for normalizing using the competition path metric values, while the first normalization method shown in FIG. 3 is a method for normalizing using the survival path metric values. As stated above, the competition path metric values have smaller values than the survival path metric values. This is because the competition path metric values have more error ingredients than the survival path metric values. FIGS. 7A and 7B show the competition path metric values for the worst case, for convenience of explanation. Unlike the survival path metric, the competition path metric does not have the overflow problem. This is because the competition path metric values have smaller values than the survival path metric values. However, in the worst case, the competition path metric may have a underflow problem, as shown in FIGS. 7A and 7B. A structure of the normalization part for preventing the underflow will be described with reference to FIG. 6. The second embodiment will be

described for the constraint length K=3 as in the first embodiment.

Sur metric values and Cpt metric values of the present states are applied to associated adders 301. A comparator 303 monitors the Cpt metric values to detect the Cpt metric values transitioning to the next states. After detecting the Cpt metric values, the comparator 303 detects the minimum Cpt metric value Cpt_{MIN}. After detecting the Cpt_{MIN} value, the comparator 303 determines whether the Cpt_{MIN} value is greater than a threshold value. When the Cpt_{MIN} value is greater than a threshold value, the comparator 303 provides the adders 301 with a specific level value (hereinafter, referred to as a normalization value) determined through computer simulation, to subtract the normalization value to all the metric values, thereby to output the resulting normalized metric values to the corresponding next states. FIGS. 7A and 7B show the normalization process for the case where the threshold value is –64 and the normalization value is 64. Herein, it is noted that the Sur metric values are normalized to a specific level and the Cpt metric values have no underflow.

FIG. 8 shows a normalization method according to the second embodiment of the present invention. Referring to FIG. 8, the comparator 303 detects the accumulated Cpt metric values of the respective states in step 501. After detecting the accumulated Cpt metric values, the comparator 303 detects the minimum Cpt metric value Cpt_{MIN} out of the Cpt metric values in step 502. After detecting the minimum Cpt metric value Cpt_{MIN}, the comparator 303 determines in step 503 whether the Cpt_{MIN} value is greater than a threshold value. When the Cpt_{MIN} value is greater than the threshold value, the comparator 303 provides a predetermined normalization value to the subtracters 301 to subtract the normalization value from all the metric values, thereby to output the normalized metric values to the next states. Thereafter, the normal addition, comparison and selection operation in the next transition state is performed in step 507. However,

when the Cpt_{MIN} value is less than the threshold value in step 503, the comparator 303 does not perform normalization to prevent underflow and proceeds to step 507 to perform the normal addition, comparison and selection operation in the next transition state.

As described above, the invention can prevent overflow and underflow errors by normalizing accumulated metric values, thereby making it possible to increase a memory utilization efficiency.

While the invention has been shown and described with reference to a certain preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

WHAT IS CLAIMED IS:

1. A method for normalizing metric values in a decoder which uses a plurality of metric values of a next state said each metric value having at least a survival path metric value and a competition path metric value, the method comprising the steps of:

detecting the survival path metric values out of the metric values;

detecting a minimum survival path metric value out of the detected survival path metric values;

determining whether the detected minimum survival path metric value exceeds a threshold value; and

subtracting, when the minimum survival path metric value exceeds the threshold value, the minimum survival path metric value from the metric values, to output normalized metric values.

2. A device for normalizing metric values in a decoder which uses a plurality of metric values of a next state, said each metric value having at least a survival path metric value and a competition path metric value, the device comprising:

a comparator for detecting the survival path metric values out of the metric values, detecting a minimum survival path metric value out of the detected survival path metric values, and outputting the minimum survival path metric value when the detected minimum survival path metric value exceeds a threshold value; and

subtracters for subtracting the minimum survival path metric value from the metric values.

3. A method for normalizing metric values in a decoder which uses a plurality of metric values of a next state, said each metric value having at least a survival

path metric value and a competition path metric value, the method comprising the steps of:

detecting the competition path metric values out of the metric values;

detecting a minimum competition path metric value out of the detected competition path metric values;

determining whether the detected minimum competition path metric value is greater than a threshold value; and

subtracting, when the minimum competition path metric value is greater than the threshold value, a given normalization value to the metric values, to output normalized metric values.

4. A device for normalizing metric values in a decoder which uses a plurality of metric values of a next state, said each metric value having at least a survival path metric value and a competition path metric value, the device comprising:

a comparator for detecting the competition path metric values out of the metric values, detecting a minimum competition path metric value out of the detected competition path metric values, and outputting a reference metric value when the detected minimum competition path metric value is greater than a threshold value; and

subtracters for subtracting the reference metric value to the metric values.

5. A method of normalizing metric values in a decoder which uses a plurality of next state metric values, each of said metric values having at least a survival path metric value and a competition path metric value, the method comprising the steps of:

detecting the survival path metric values out of the metric values;

detecting a minimum survival path metric value out of the detected survival path metric values;

determining whether the detected minimum survival path metric value exceeds a threshold value; and

subtracting, when the minimum survival path metric value exceeds the threshold value, the minimum survival path metric value from the metric values, to output normalized metric values;

detecting the competition path metric values out of the metric values;

detecting a minimum competition path metric value out of the detected competition path metric values;

determining whether the detected minimum competition path metric value is greater than a threshold value; and

subtracting, when the minimum competition path metric value is greater than the threshold value, a given normalization value to the metric values, to output normalized metric values.

ABSTRACT

Disclosed is a method for normalizing metric values in a decoder which uses a plurality of metric values of a next state in a state transition period having a present state and the next state, each metric value having a survival path metric value having a value equal to or higher than a competition path metric value. The method comprises detecting the survival path metric values out of the metric values; detecting a minimum survival path metric value out of the detected survival path metric values; determining whether the detected minimum survival path metric value exceeds a threshold value; and subtracting, when the minimum survival path metric value exceeds the threshold value, a given normalization value from the metric values, to output normalized metric values. Also disclosed is another method for normalizing metric values in a decoder which uses a plurality of metric values of a next state in a state transition period having a present state and the next state, each metric value having a survival path metric value having a value equal to or higher than a competition path metric value. The method comprises detecting the competition path metric values out of the metric values; detecting a minimum competition path metric value out of the detected competition path metric values; determining whether the detected minimum competition path metric value is greater than a threshold value; and subtracting, when the minimum competition path metric value is greater than the threshold value, a given normalization value to output normalized metric values.

FIG. 1

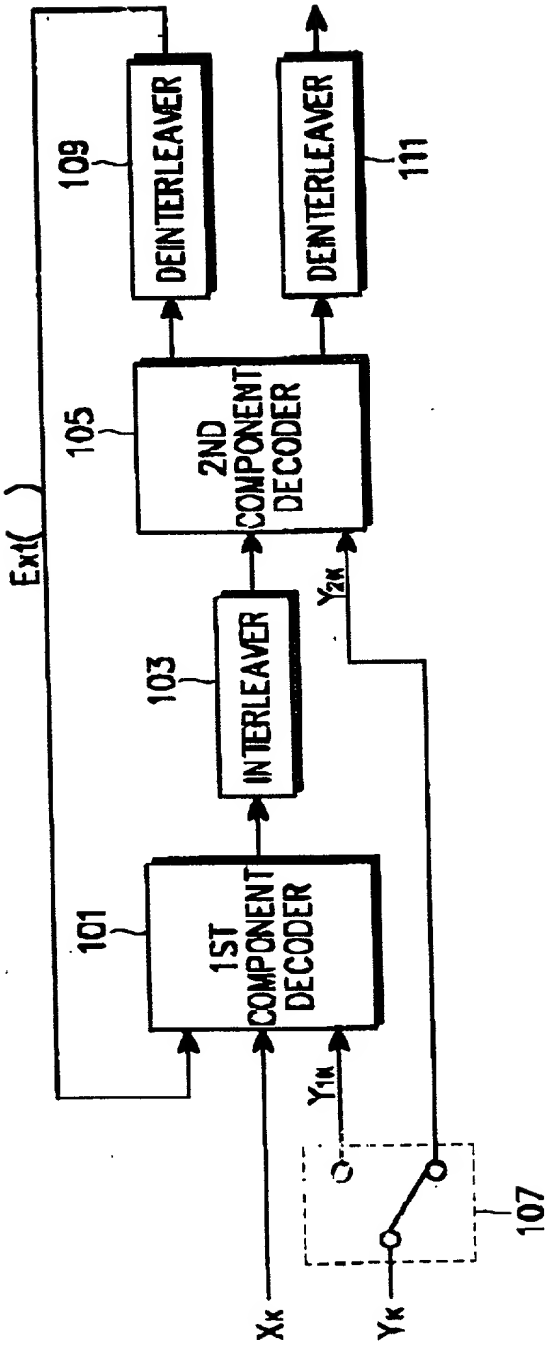
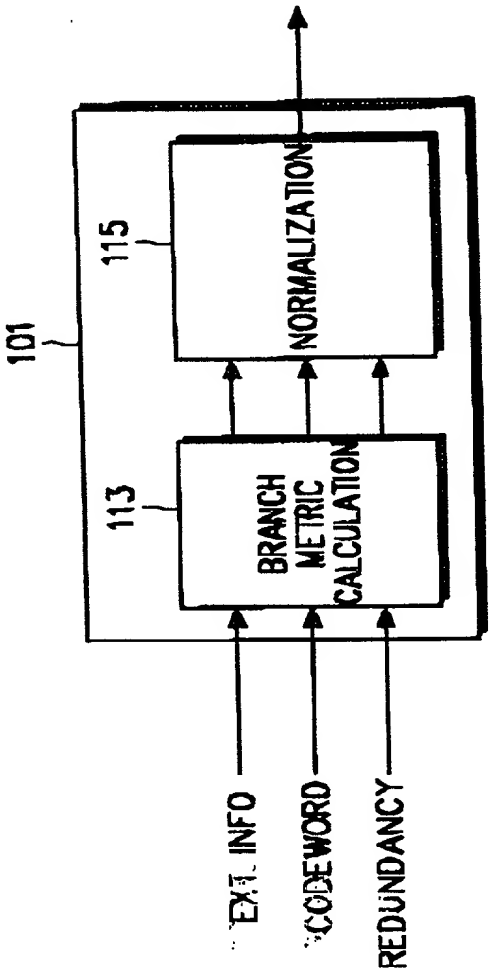

1ST COMPONENT DECODER
101
INTERLEAVER
103
2ND COMPONENT DECODER
105
DEINTERLEAVER
109
DEINTERLEAVER
111
Ext( )
Y1K
Y2K
107
Xk
Yk

FIG. 2


101
113
BRANCH METRIC CALCULATION
115
NORMALIZATION
EXT. INFO
CODEWORD
REDUNDANCY

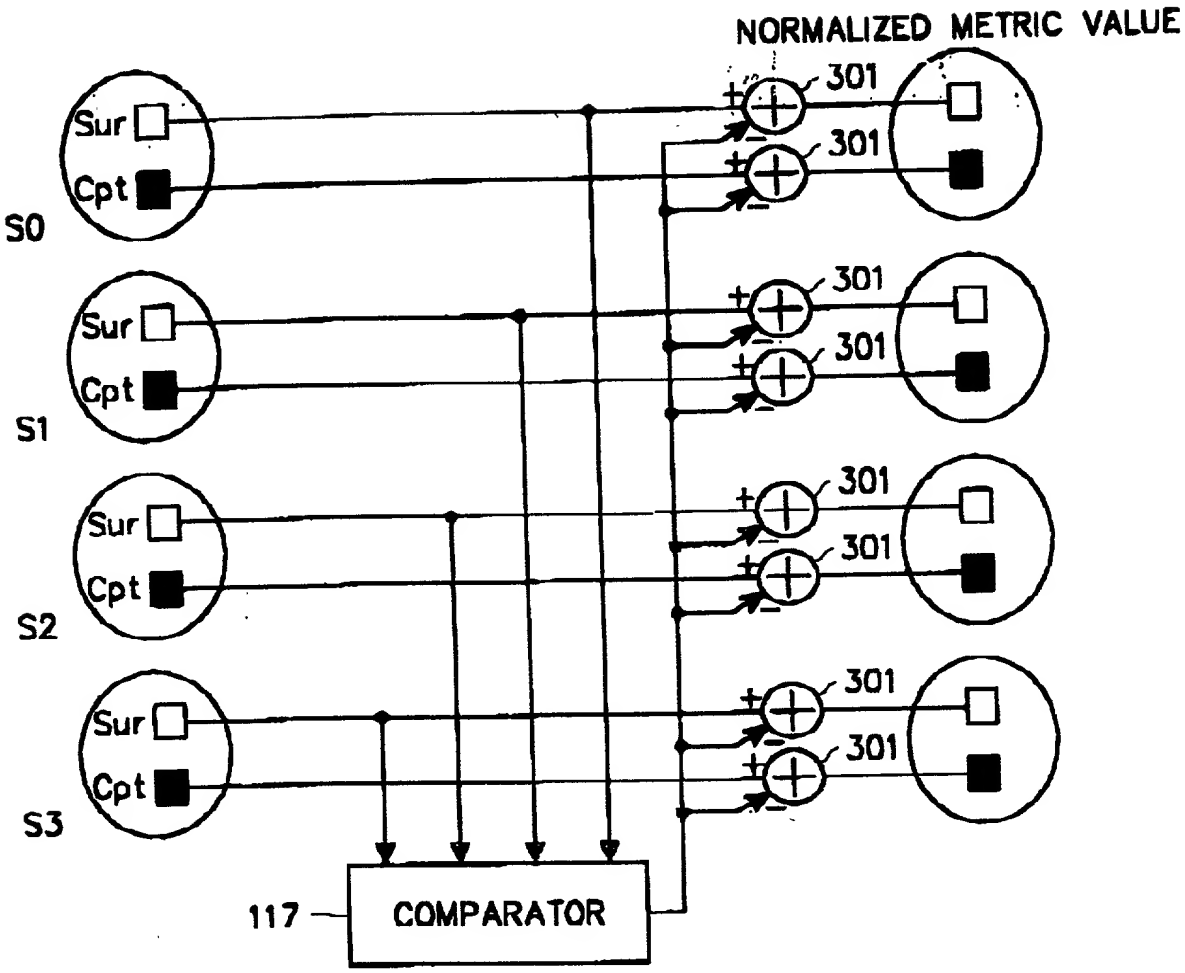

NORMALIZED METRIC VALUE
301
301
Sur
Cpt
S0
301
301
Sur
Cpt
S1
301
301
Sur
Cpt
S2
301
301
Sur
Cpt
S3
117
COMPARATOR

FIG. 3

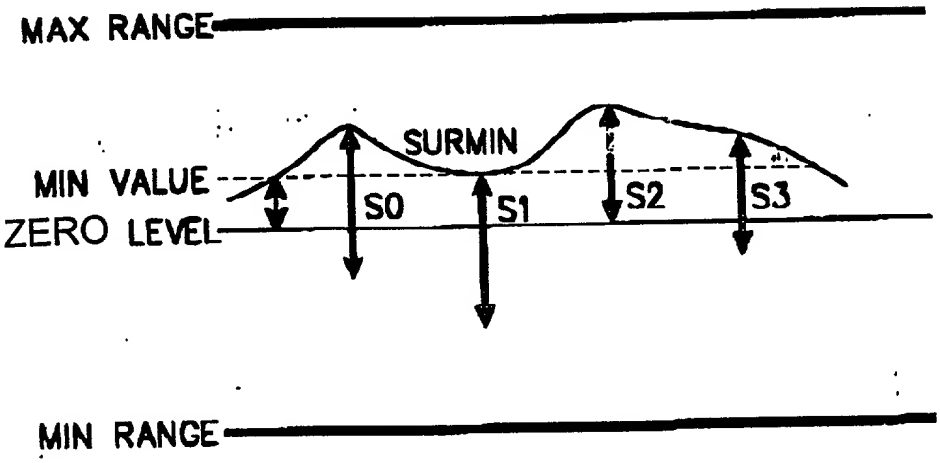

MAX RANGE
SURMIN
MIN VALUE
ZERO LEVEL
S0
S1
S2
S3
MIN RANGE

FIG. 4A

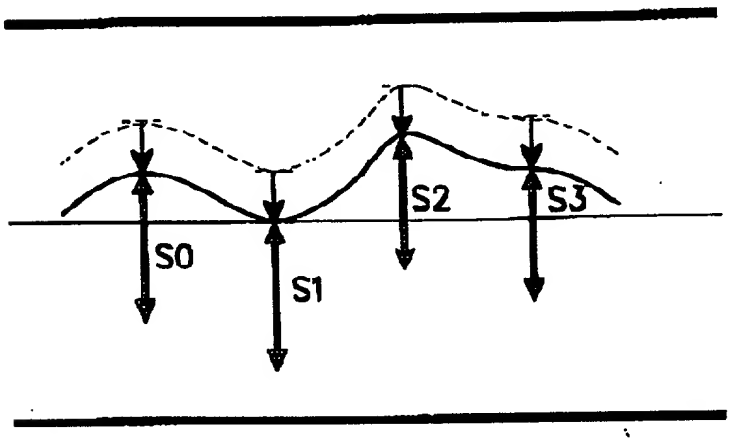

S0
S1
S2
S3

FIG. 4B

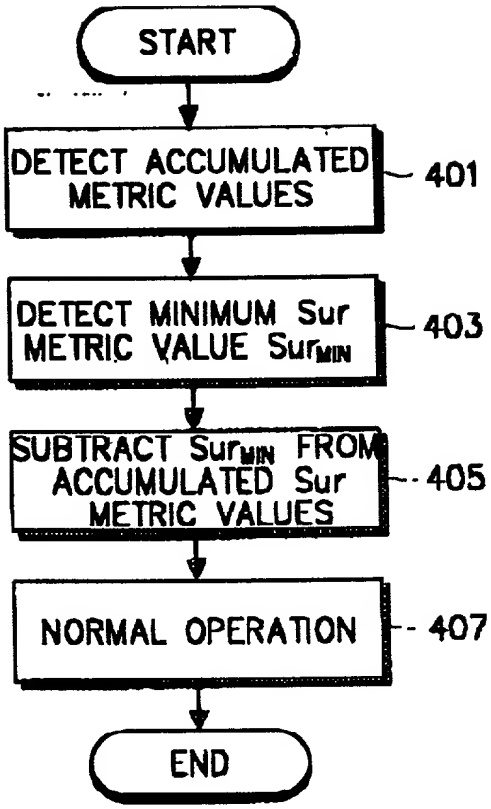

START
DETECT ACCUMULATED METRIC VALUES
401
DETECT MINIMUM Sur METRIC VALUE Sur_{MIN}
403
SUBTRACT Sur_{MIN} FROM ACCUMULATED Sur METRIC VALUES
405
NORMAL OPERATION
407
END

FIG. 5

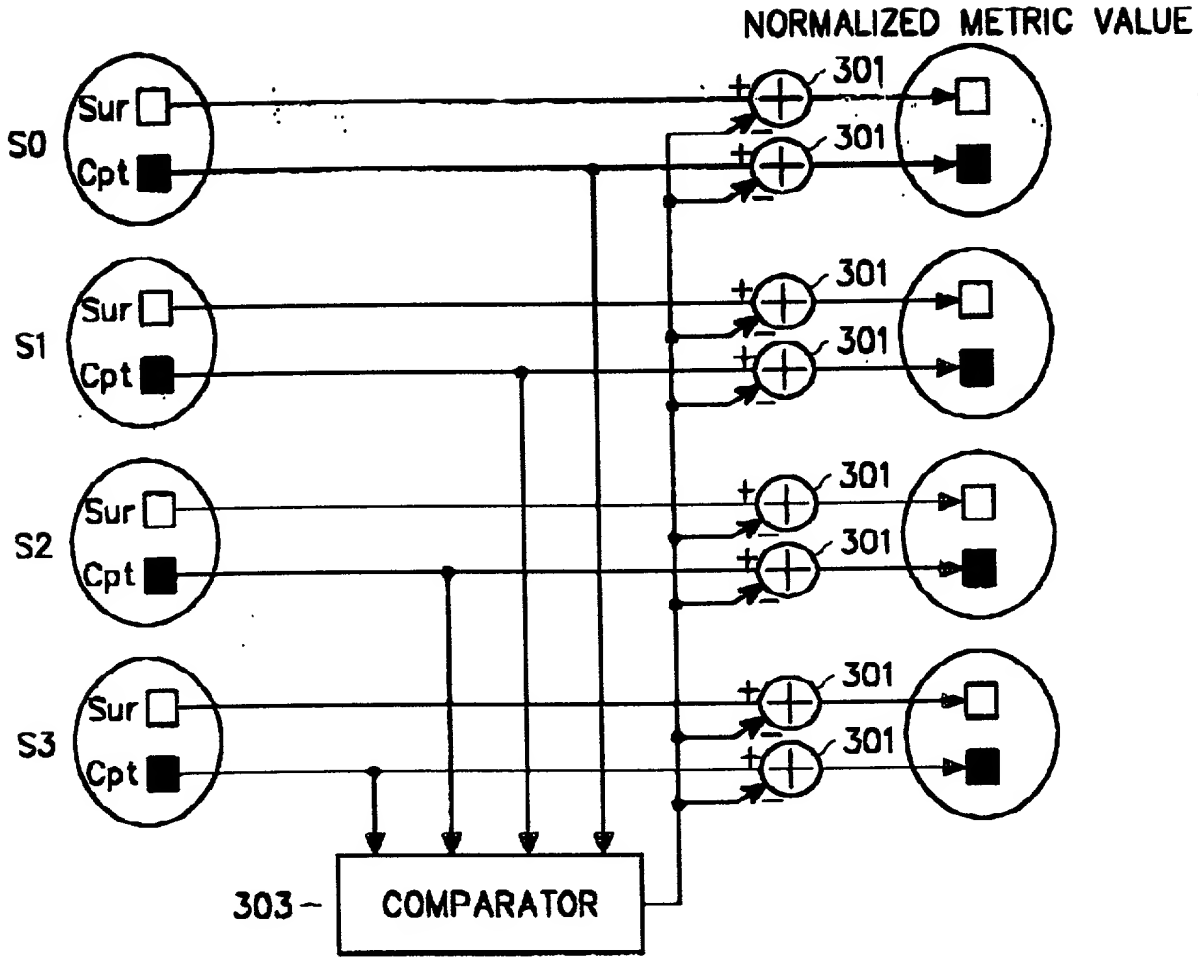

NORMALIZED METRIC VALUE
S0
S1
S2
S3
Sur
Cpt
301
303
COMPARATOR

FIG. 6

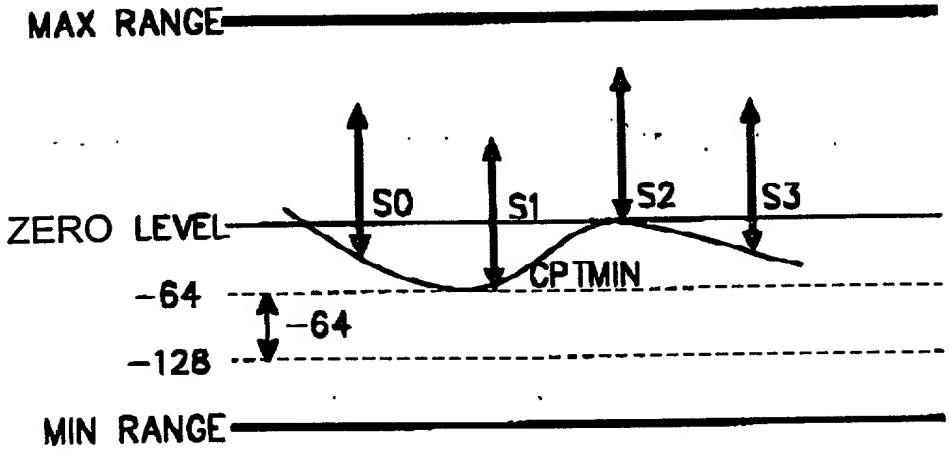

MAX RANGE
S0
S1
S2
S3
ZERO LEVEL
CPTMIN
-64
-64
-128
MIN RANGE

FIG. 7A

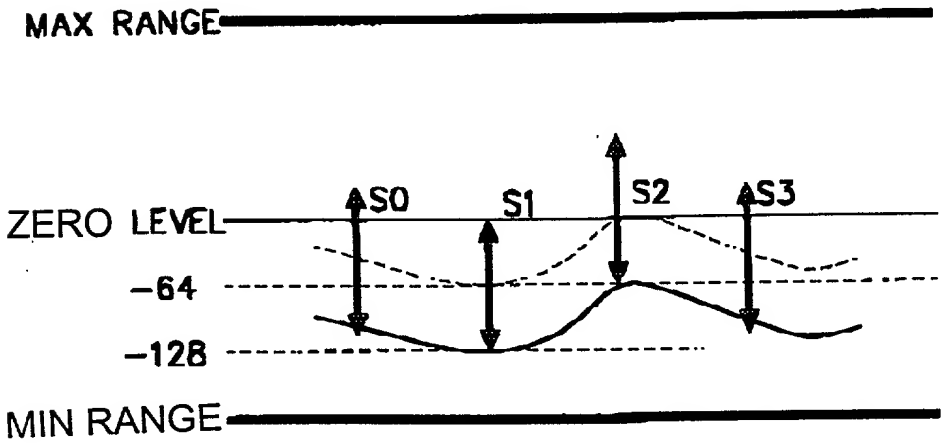

MAX RANGE
S0
S1
S2
S3
ZERO LEVEL
-64
-128
MIN RANGE

FIG. 7B

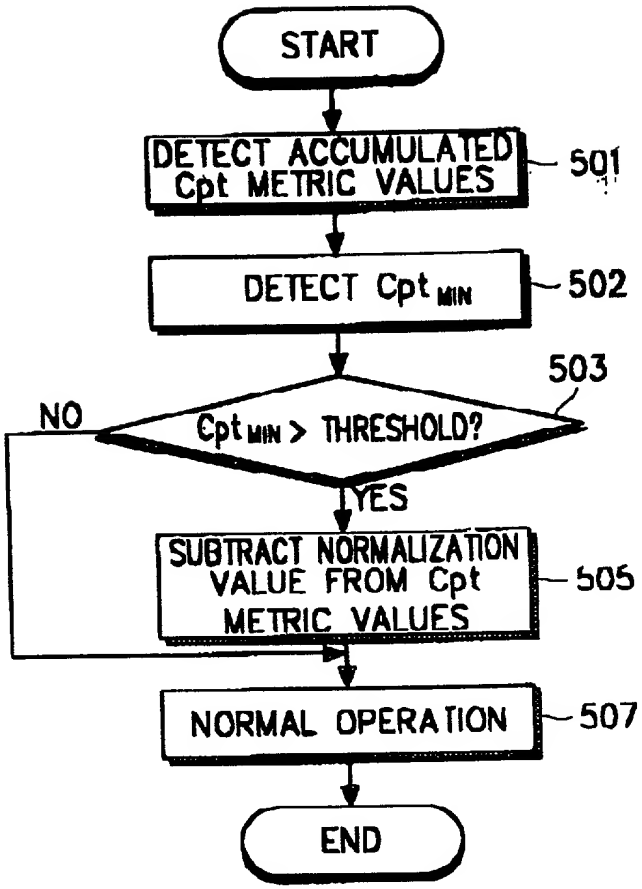

START
DETECT ACCUMULATED Cpt METRIC VALUES
501
DETECT Cpt MIN
502
503
NO
Cpt MIN > THRESHOLD?
YES
SUBTRACT NORMALIZATION VALUE FROM Cpt METRIC VALUES
505
NORMAL OPERATION
507
END

FIG. 8

PTO/SB/01 (6/95)

DECLARATION

Docket No. 678-474 (P9192)

AS A BELOW NAMED INVENTOR, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name.

I believe that I am the original, first and sole *(if only one name is listed below)*, or an original, first and joint inventor *(if plural names are listed below)*, of the subject matter which is claimed and for which a patent is sought on the invention entitled:

TITLE: APPARATUS AND METHOD FOR NORMALIZING METRIC VALUES IN A COMPONENT DECODER IN A MOBILE COMMUNICATION SYSTEM

the specification of which either is attached hereto or indicates an attorney docket no. 678-474 (P9192) or:

[ ] was filed in the U.S. Patent & Trademark Office on _____ and assigned Serial No. _____.

[ ] and *(if applicable)* was amended on _____.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to patentability and to the examination of this application in accordance with Title 37 of the Code of Federal Regulations §1.56. I hereby claim foreign priority benefits under Title 35, U.S. Code §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States, or §119(e) of any United States provisional application(s), listed below and have also identified below any foreign applications for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

			Priority Claimed:
1998-15223	Korea	28/04/1999	Yes [X] No [ ]
(Application Number)	*(Country)*	*(Day/Month/Year filed)*	
			Yes [ ] No [ ]
(Application Number)	*(Country)*	*(Day/Month/Year filed)*	

I hereby claim the benefit under Title 35, U.S. Code, §120, of any United States application(s), or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application(s) in the manner provided by the first paragraph of Title 35, U.S. Code, §112, I acknowledge the duty to disclose information material to patentability as defined in Title 37, The Code of Federal Regulations, §1.56(a) which became available between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial Number)	*(Filing Date)*	*(STATUS: patented, pending, abandoned)*
(Application Serial Number)	*(Filing Date)*	*(STATUS: patented, pending, abandoned)*

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I HEREBY DECLARE that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 U.S. Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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FULL NAME OF FOURTH JOINT INVENTOR: _____ Citizenship _____

Inventor's signature: _____ Date: _____
Residence & Post Office Address:

FULL NAME OF FIFTH JOINT INVENTOR: _____ Citizenship _____

Inventor's signature: _____ Date: _____
Residence & Post Office Address:

FULL NAME OF SIXTH JOINT INVENTOR: _____ Citizenship _____

Inventor's signature: _____ Date: _____
Residence & Post Office Address: